An Empirical Test of Okun's Coefficient in Indonesia

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ABSTRACT

Unemployment and gross domestic product are persistent challenges for every country, especially the developing ones. As a developing country, Indonesia aims simultaneously to reduce unemployment and to increase gross domestic product. Therefore, this study explains the presence of Okun's coefficient in Indonesia from 1985 to 2018. The econometric model of the Hodrick-Prescott Filter and Vector Error Correction Model captures the impact of the real gross domestic product on the open unemployment rate. The Hodrick-Prescott Filter results revealed that the coefficient does not exhibit substantial differences. Moreover, the Vector Error Correction Model results show that the real gross domestic product has a negative and significant effect on the open unemployment rate. Indonesia's geographical condition consists of thousands of islands that cause the implementation of policies to take a longer time. This study presents evidence to support the existence of Okun's coefficient in Indonesia. Therefore, the Indonesian government needs to increase the real gross domestic product to reduce the open unemployment rate. The study contributes to the literature on the Indonesian economy by using the Hodrick-Prescott (HP) Filter gap model.

Keywords**:** Hodrick-Prescott Filter, Okun's Coefficient, Vector Error Correction Model.

1. INTRODUCTION

Reducing unemployment and increasing economic growth are the priorities of both developing and developed countries. Thus, economic growth and employment rates are two very crucial macroeconomic variables and the integral elements of economic policies (Soylu, Cakma, & Okur 2018; Sukanto, 2012). In this respect, unemployed individuals are those who do not work at all, seek employment, work at least two days per week, or in the process of seeking employment (Central Bureau of Statistics, 2018a). It is estimated that the urban population comprised 53.3 percent to 56.7 percent in 2015-2020 while the proportion of urban employment to total employment in 2018 was only 44.13 percent (Central Bureau of Statistics, 2018c). Increased urban population due to urbanization causes higher urban unemployment that will eventually imply various economic and social impacts, especially when unemployment mainly consists of the working-age population. Unemployment is a social phenomenon because of its effect on the social structure of the population (Jaradat, 2013). Numerous countries try to control the unemployment rate in their economies because the increased unemployment rate negatively affects the economy of the countries (Alamoudi, 2016). Consequently, the production of potential outputs of an economy needs to consider the optimal use of human resources (Arewa & Nwakanma, 2012; Fouquau,

2012; Mankiw, 2016; Phiri, 2014; Sogner & Stiassny, 2000). In this respect, Arthur Okun developed a model that explained the relationship between real GDP and unemployment rate. Empirically, holding other factors constant, a 3 percent output growth implies a 1 percent decrease in the unemployment rate (Caraiani, 2010; Elshamy, 2013; Okun, 1962). Understandably, increased production will absorb more labor force. In other words, increased GDP implies reduced unemployment. However, these two variables (unemployment and GDP) do not change in the same proportions. GDP changes more rapidly than unemployment does. Thus, the inverse relationship between GDP and unemployment rate is defined by Okun's Law (Akram *et al*., 2014; Kargi, 2016; Lang & de Peretti, 2009; Mankiw, 2016; Plosser & Schwert, 1979; Blazquenz-Fernandez, Cantarero-Prieto, & Pascual-Saez, 2018).

Economists analyze Okun's law with two approaches, namely the difference model and the gap model (Knotek, 2007). Mathematically, Okun's law can be derived into the equation $Ut = a + b (\Delta Yt / Yt)$. ΔUt denotes the change in the unemployment rate in year t. $\Delta Yt / Yt$ refers to the real GDP growth rate, and the b coefficient defines the change in unemployment due to the change in GDP (Okun's coefficient). Okun's coefficient is an important component in the economy of a country because of three main reasons. First, if the unemployment rate is a policy variable, then Okun's coefficient can explain most of the economy targets to reduce the unemployment rate. Second, expected outputs are often used to predict expected unemployment. Three, Okun's coefficient is useful to finding out whether outputs are above or below their potential values (Sinclair, 2005).

Increased unemployment is affected by the labor market and simultaneously affects long-term economic growth. It is then understandable that demands for higher wages from labor unions make it more difficult for firms to afford (Adjemian, Langot, & Quintero-Rojas, 2010). Increased labor costs will lead to higher unemployment and lower economic growth. Consequently, bargaining processes in the labor market aim to reach agreements between labor candidates and firms (Adjemian *et al*., 2010). The argument implies that activities in the labor market will affect activities in the good market during the long-term business cycles (Bande, Angel, & Roman, 2017; Mielcova, 2011). Thus, decreasing economic growth is closely related to a higher unemployment rate. In Indonesia, the unemployment rate continued to increase to 11.24 percent (2000 to 2005). However, from 2006 to 2018, the open unemployment rate decreased to 5.34% in 2018 (Central Bureau of Statistics, 2019b). Conversely, real GDP tends to increase until 2018. In essence, increased outputs are not affected by the unemployment rate. However, increased production of goods and services are affected by the increased labor force, regular capital addition, and technological development (Rahman & Mustafa, 2015).

Increased economic activities are related to productivity and unemployment (Moroke, 2014). Understandably, more labor forces that are absorbed by the labor market will increase their productivity (Noor, Nor, & Ghani, 2008). Further, increased productivity implies increased economic growth. The arguments are in line with macroeconomic policies to determine optimal economic growth (Alamoudi, 2016; Moosa, 1997; Silvapulle, Moosa, & Silvapulle, 2016). However, increased GDP sometimes cannot create more employment opportunities, while increased jobs cannot employ all labor forces. Thus, economists and policymakers aim to create an optimal job market and maintain price stability. Decreased unemployment should be consistent with long-term economic growth. The objectives are in line with Okun's arguments that indicate the relationships between economic growth, the gap between real and potential gaps, and unemployment rate (Abdul-khaliq, Soufan, & Shihab, 2014; Al-habees & Rumman, 2012; Alamro & Al-dala'ien, 2016; Blanchard & Quah, 2010; Darman, 2013; Gocer & Erdal, 2015; Kori Yahia, 2018; Phiri, 2014; Pierdzioch, Rülke, & Stadtmann, 2011; Reich, 2012).

Unemployed labor forces potentially contribute to national income if labor markets fully absorb them. There are two types of unemployment: frictional and structural. Such unemployed labor forces will stop searching jobs after having jobs that match their skills, and firms are willing to pay their wages above the equilibrium wage (Akram et al., 2014). Thus, governments need to provide labor market and to set wages to the equilibrium point. Meanwhile, other factors that affect labor force absorption in labor markets are the differences in age, sex, and education level (Blazquenz-Fernandez et al., 2018; Zanin, 2016; Zanin & Marra, 2011b). In the context of the Economic ASEAN Community, it is understandably difficult to reduce the unemployment rate. However, with its labor training programs, the Indonesian government principally is oriented on the needs of the labor market and human resource development (Government Regulation Number 31, 2006). Thus, the confirmation of Okun's coefficient is context-specific both in developed and developing countries (Sukanto, 2012).

2. THEORETICAL FRAMEWORK

Okun's Law explains the negative relation between the unemployment gap ($U–U_n$) and output gap ($Y–Y^p$). An economy produces potential outputs when all human resource factors are fully employed or utilized. Conversely, real output refers to national outputs produced when several factor units are still unemployed (Mishkin, 2016). The following equation explains the negative relationship between unemployment and outputs:

$$U - U_n = -0.5 \times (Y - Y^p) \quad (1)$$

Where:
U : The natural unemployment rate
U_n : The unemployment rate in year-end
Y : Real GDP
Y^p : Potential GDP

The following are the specified models of Okun's law. The first difference model can be seen in Equations 2 and 3 below.

$$Y_t - Y_{t-1} = \alpha + \beta (U_t - U_{t-1}) + \varepsilon_t \quad (2)$$

$$\Delta Y_t = \alpha + \beta \Delta U_t + \varepsilon_t \quad (3)$$

Where:
Y_t : Real GDP in year t
Y_{t-1} : Real GDP in year t – 1
U_t : Open unemployment rate in year t
U_{t-1} : Open unemployment rate in year t - 1

Meanwhile, the gap model can be seen in Equation 4 below.

$$\frac{(Y_t - Y_t^*)}{Y_t^*} = \theta + \delta (U_t - U^*) + \eta_t \quad (4)$$

Where:
Y_t^* : Potential GDP in year t
U_t : Natural unemployment rate in the observation period

The estimation of open unemployment rate relies on the initial equation of Okun's law:

$$\omega\ (\ U^* - U_t\ ) = \frac{(Yt - Yt^*)}{Yt^*} \quad (5)$$

$$U_t = U^* - \frac{1}{\omega}\left(\frac{(Yt - Yt^*)}{Yt^*}\right) + \mu_t \quad (6)$$

$$U_t = U^* - \phi G_t + \mu_t \quad (7)$$

Okun's law argues that for each 1 percent output above potential GDP, the unemployment rate will decrease by 0.5% below the natural unemployment rate. Thus, the reduction of unemployment is only half of the increased outputs. It is understandable that when outputs increase, firms do not add labor proportionally to the output increase but add labor hours first. Consequently, there will be an accumulation of laborers because not all labor forces are absorbed in the job markets (Mankiw, 2016).

The literature has investigated the relationship between GDP and unemployment rate in various countries, In Eastern European countries, by using Pooled Panel OLS and Johansen's Panel Cointegration, Soylu, Cakmak, and Okur (2018) empirically show economic growth has the negative impact on the unemployment rate. In particular, a one percent increase in GDP reduces the unemployment rate by 0.08 percent. In Jordan, by using ANOVA, Jaradat (2013) observes the negative relationship (-0.697 percent) between the unemployment rate and GDP, thus implying a 0.697 percent decrease in the unemployment rate will increase GDP by one percent. In the member countries of the Gulf Cooperation Council, the OLS model of Alamoudi (2016) indicates national income is negatively related to the unemployment rate. In particular, a one percent increase in national income decreases the unemployment rate by 0.041 percent. In Saudi Arabia, by using Pooled EGLS (Cross-section SUR), Abdul-khaliq *et al.* (2014) demonstrate economic growth negatively affects the unemployment rate. Specifically, a one percent increase in economic growth will reduce the unemployment rate by 0.16 percent. Further, the Hodrick-Prescott filter gap model and Error Correction Model of Alamro and Al-dala'ien (2016) find a one percent increase in economic growth reduces the unemployment rate by 0.007 percent in Jordan. Still, in Jordan, Al-hosban and Edienat (2017) use VECM and observe that a 100 million Dinar increase in real GDP will reduce the unemployment rate by 40 percent. In the United Kingdom, by using the OLS model, Petkov (2008) finds a one percent increase in national income reduces total unemployment by 13-23 percent. In the European Union (EU) member countries, Dritsaki, and Dritsakis (2009) use the Hodrick and Prescott filter to show the negative relationship between economic growth and the unemployment rate in each member country. In Algeria, by using Autoregressive Distributed Lag and Normal Bayesian Linear Regression, Kori Yahia (2018) observes that the estimated value of Okun's coefficient exhibits a significant impact both in the short-run and long-run. In G7 countries, Pierdzioch *et al.* (2011) indicate the significant negative relationship between the expected change of unemployment rate and the expected growth of real outputs. In Organisation for Economic Co-operation and Development (OECD) member countries, the non-dynamic transition regression of Fouquau (2012); Sogner and Stiassny (2000) empirically find the strong negative relationship between the unemployment rate and outputs. In 13 developed countries, Rahman and Mustafa (2015) use the Bivariate Error-Correction Model and demonstrate that Okun's law is relatively valid in the US and South Korea. Outputs are more likely to increase when job markets are more flexible. In Euro-Area countries, Zanin and Marra (2011) employ the spline regression approach to show the coefficient increases, especially for Spain, Portugal, Ireland, Finland, and Italy. However, Italy is the only country with an insignificant Okun's coefficient. Meanwhile, Spain, Finland, and Ireland exhibit the highest Okun's coefficients with significantly negative signs. In Indonesia, Sukanto (2012) uses the VAR model to demonstrate a trade-off between economic growth and unemployment, as indicated by the negative sign between these two variables.

Still, in Indonesia, Darman (2013) employs the difference version and ordinary least square methods and observes that GDP grows by 2.5% above its trend, while the rate declines by one percent. The condition suggests economic growth negatively affects the unemployment rate. The most recent study by Lee and Huruta (2019) proved the Okun's law is valid in Indonesian economy. An increase in GDP implied a high number of workers in the production process. It can be understood when the GDP increased, it should have been followed by an increase in demand for labor.

Different from previous results, the Granger causality test of Noor *et al.* (2008) shows the negative relationship between the unemployment rate and outputs. The regression coefficient of -1.748 indicates the unemployment rate is a factor that affects the change in outputs in Malaysia. In Spain, Bande *et al.* (2017) use the Hodrick- Prescott filter and GMM to demonstrate the unemployment rate has a significantly negative impact on GDP growth. In Europe, Blazquenz-Fernandez *et al.* (2018) employ the Hodrick- Prescott filter method and find the negative relationship between unemployment and output, thus suggesting economic growth is closely related to the greater unemployment rate. In OECD countries, the Error Correction Model used by Kargi (2013) shows the inverse relationship between unemployment and growth, as indicated by the fact that increased unemployment reduces GDP. In Romania, Ruxandra (2016) uses the Hodrick-Prescott filter and finds the unemployment rate is negatively related to outputs as suggested by Okun's coefficient of -0.61. The value suggests that a one percent increase in cyclical unemployment reduces the output gap by 0.61 percent. In South Africa, Phiri (2014) employs the Momentum Threshold Autoregressive to confirm the presence of Okun's law. The findings also suggest unemployment leads to long-term economic growth.

The relationship between the unemployment rate and output is not always significant. In Italy, Zanin (2016) uses the binary generalized extreme value additive model to demonstrate the insignificant differences based on sex and age range. In Romania, the Bayesian approach used by Caraiani (2010) indicates that the Okun's coefficients are between -0.15 and -0.20 with insignificant distribution at average posterior results. In OECD countries, Zanin (2014) employs the cohort analysis to show the estimated Okun's coefficient is not always statistically significant for each population subgroup. In particular, the young male population tends to dominate the labor force in developing and developed OECD countries. In Nigeria, the Vector Autoregressive (VAR) used by Arewa and Nwakanma (2012) find that Okun's coefficient is insignificant in the Nigerian economy. Their results imply the proposition predicts that a one percent increase in unemployment rate reduces outputs by 3 percent is invalid in Nigeria. Lastly, in Pakistan, Akram *et al.* (2014) use OLS to show Okun's law is not valid in the Pakistani economy. Okun's coefficient can be explained with various versions, such as gap version, difference versions, and dynamic versions.

3. METHODOLOGY

This study uses 1985 to 2018 time-series secondary data from the World Bank and Central Bureau of Statistics (Central Bureau of Statistics, 2019b; World Bank, 2018) that consists of potential and real GDP, and natural and open unemployment rate. In this respect, Okun's coefficient aims to determine whether outputs are above or below their potential values (Sinclair, 2005). Further, the Hodrick-Prescott (HP) filter is crucial to generate smoother trend estimations on real GDP and the unemployment rate (Polasek, 2011). HP filter decomposes the original series (Y_t) into the trend component (S_t) and the cycle component (C_t). The cycle component is the differentiates between the original series and the component.

$$Y_t = S_t + C_t \quad (8)$$

The method is a two-sided (backward-forward) filter to smoothy series into s series. The smoothing process aims to minimize y variant around s with the parameter of λ = 100 as the constraint of the sum square of the second difference of series s. Thus, the HP filter chooses s to minimize the variant.

$$\sum_{t=1}^{T}(Yt - St)^2 + \lambda \sum_{t-2}^{T-1}((S_{t+1} - S_t) - (S_t - S_{t-1}))^2 \quad (9)$$

The stationary test investigates the consistency of time-series movements (Winarno, 2015). The following is the equation of the stationary test:

$$\Delta Y_t = \beta_1 + \beta_{2t} + \delta Y_{t-1} + \mu_t \quad (10)$$

Next, we run the classical assumption tests comprising of normality, heteroskedasticity, and autocorrelation tests to ensure that the model qualifies for the BLUE components (Johnson & Wichern, 2002; Winarno, 2015). After running the classical assumption test, the study also runs the Granger causality test (Winarno, 2015):

$$X_t = \sum_{i=1}^{m} a_i X_{t-i} + \sum_{j=1}^{n} b_j Y_{t-j} + \mu_t \quad (11)$$

$$Y_t = \sum_{i=1}^{r} c_i Y_{t-i} + \sum_{j=1}^{s} d_j X_{t-j} + V_t \quad (12)$$

The above equation shows that X_t is Real GDP, and Y_t is the open unemployment rate, while μ_t and ν_t are error terms that are assumed not to exhibit serial correlation, and m = n = r = s. Besides, the co-integration test also shows the long-term relationship between variables as can be seen in the following equation.

$$\Delta \hat{\mu} = \rho \hat{\mu}_{t-1} + \sum_{1}^{\rho} \alpha i \ \Delta \hat{\mu}_{t-1} + e_t \quad (13)$$

Johansen and Juselius popularize the Vector Error Correction Model (VECM) concept (Chevallier, 2013). VECM differentiates the long-run component and short-run component in the process of data formulation. The following equation explains the VECM model.

$$\Delta Y_t = \mu_{0x} + \mu_{1x}{}^t + \Pi_x y_{t-1} + \sum \frac{k-1}{i=1} \Gamma_{Ix} \Delta y_{t-i} + e_t \quad (14)$$

Where:

Y_t : The vector that contains research variables
μ_{0x} : Intercept vector
μ_{1x} : Regression coefficient vector
t : Time trend
Π_x : $\alpha x \beta' \alpha x \beta'$ where $\beta'\beta'$ contains long-run cointegration equation
y_{t-1} : In – level variable
Γ_{ix} : Regression coefficient matrix
k-1 : VECM order of VAR
e_t : Error term

4. RESULTS

HP filter analyzes the long-term output and unemployment trend. Figures 1 and 2 below displays the results of the HP filter:

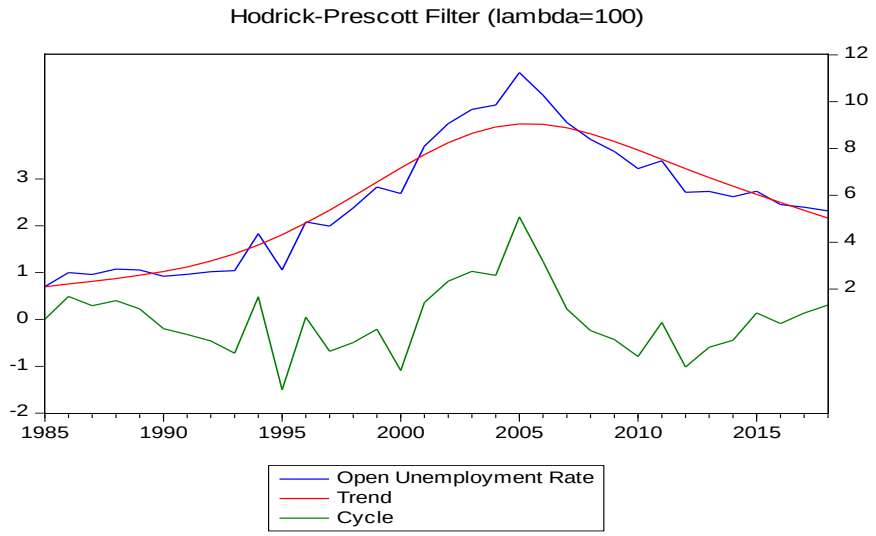

Figure 1: Hodrick-Prescott Filter Test Results of Open Unemployment Rate
Source: Author calculation

Figure 1 demonstrates the estimation pattern of HP Filter with the optimal smoothing parameter value of wλ = 100 with annual data. HP filter uses the data itself to run series smoothing and to extract trend line. Economic dynamics occur from 2002 to 2005 where the unemployment rate moves away from the trend line. Comparing the observation periods, we find that the unemployment rate does not increase significantly, and it is still within the safe limits.

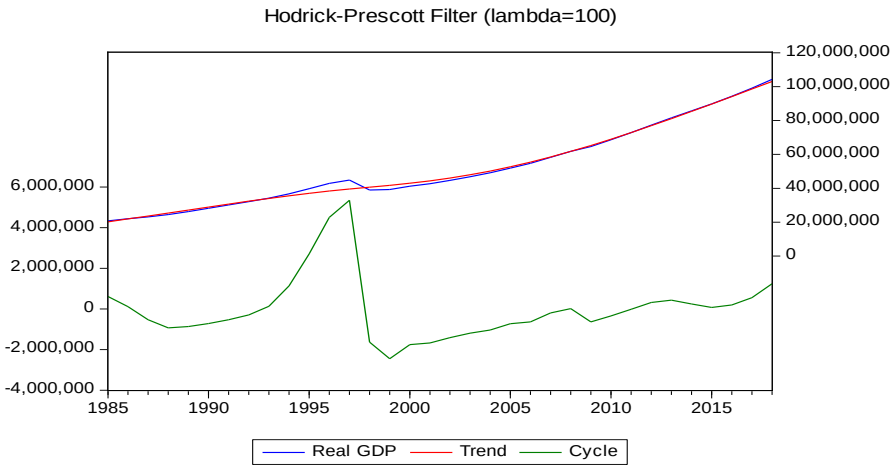

Figure 2: The Hodrick-Prescott Filter Test of Real Gross Domestic Product at constant price
Source: Authors calculation

Figure 2 shows the linear trend of the HP filter during the observation period with the optimal smoothing parameter value of λ=100. Further analysis of 1996 to 1997 reveals that the actual GDP is higher than the HP filter trend. Consequently, the HP filter trend test is appropriate because the linear trend after 1998 continues to increase until the last observation year. The condition is in line with the increasing trend of real GDP after the 1998 economic

crisis. Thus, the HP filter has produced a smoother trend estimation on these two variables. Further, the gap model of Okun's law can be explained by the following equation.

$$\Delta U_t = B_0 + B_1 \Delta GDP_t + \varepsilon_t \quad (15)$$

Where:
ΔU_t : The change in the unemployment rate in year t
B_0 : Intercept coefficient (constant)
B_1 : Coefficient's slope (Okun's coefficient)
ΔGDP_t : The change in economic growth (real GDP) in year t

Next, Table 1 below displays the results of the stationary test of both coefficients.

Table 1. Stationarity Test

Variable	Degree of Integration	Probability	Conclusion
U	Level	0.0024	Series Has Stationary
GDP	Level	0.1248	Series Has Not Stationary
D(GDP)	1st Difference	0.0000	Series Has Stationary

Notes:
U = Open Unemployment Rate
GDP = Real Gross Domestic Product
D(GDP) = Real Gross Domestic Product at the first difference
Source: Authors calculation

Table 1 demonstrates unemployment is stationary at the level integration degree [I(0)] as indicated by the probabilistic value of 0.0024. However, GDP is stationary at the first difference integration level [I(1)] as suggested by the probabilistic value of 0.0000. Meanwhile, the results of the classical assumption tests can be seen in Figure 3, Table 2, and Table 3 below.

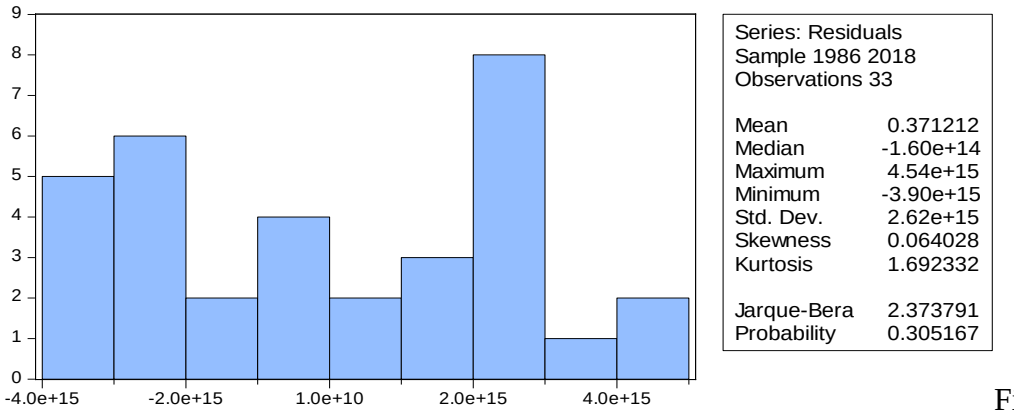

Figure 3: Normality Test
Source: Authors calculation

Figure 3 shows the residual values are normally distributed as indicated by the probabilistic value of 0.305167. Further, the autocorrelation test also suggests that the model is free from autocorrelation problems.

Table 2. Autocorrelation Test

F-statistic	1.922274	Prob. F(2,29)	0.1645
Obs*R-squared	3.862745	Prob. Chi-Square(2)	0.1449

Source: Authors calculation

Table 2 is confirmed with the probabilistic value of Chi-Square of 0.1449. Similarly, the results of the heteroskedasticity test can be seen in Table 3.

Table 3. Heteroskedasticity test

F-statistic	0.734059	**Prob. F(1,31)**	0.3981
Obs*R-squared	0.763342	**Prob. Chi-Square(1)**	0.3823
Scaled explained SS	0.233184	**Prob. Chi-Square(1)**	0.6292

Source: Authors calculation

Table 3 shows the probabilistic value of Chi-square is 0.6292, suggesting that the model is free from serious heteroskedasticity problems. Further, we run the Granger causality test to analyze the causal relationship between these two variables, as demonstrated by Table 4 below.

Table 4. Granger Causality Test

Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**	**Conclusion**
D(GDP) does not Granger Cause U**	31	6.57020	0.0049*	Significant
U does not Granger Cause D(GDP)		0.00913	0.9909	Not Significant

*Rejected the Null Hypothesis
** Implies the open unemployment
Source: Authors calculation

Table 4 displays a one-way causal relationship from GDP to the open unemployment rate, but not vice versa. The results imply that changes in GDP affect the unemployment rate as indicated by the probabilistic value of 0.0049. The value of Okun's coefficient is determined by the changes in GDP that likely affect the unemployment rate. Next, Table 5 below shows the results of the Johansen Co-integration test.

Table 5. Johansen Co-integration Test

Hypothesized No.of CE(s)	**Eigenvalue**	**Trace test**		**Max - Eigen test**	
		Trace Statistic	**Prob.****	**Max - Eigen Statistic**	**Prob.****
None *	0.509736	27.36399	0.0005	22.09716	0.0024
At most 1 *	0.156249	5.266830	0.0217	5.266830	0.0217

**MacKinnon-Haug-Michelis p-values
Source: Authors calculation

Tables 5 suggests the statistic value of trace and Max-Eigen tests are greater than the critical value (α=5 percent). The results indicate that GDP and the open unemployment rate are mutually integrated and exhibit a stationary linear relationship. When a co-movement of the variables in the long-run, it is necessary to run the Vector Error Correction Model test. Table 7 below displays the results of this test.

Table 7. Vector Error Correction Model Test

Coefficient	Coefficient Value	Std Error	t-Statistic	Prob.	R-squared	D-Watson
C 1	-0.322240	0.10955	-2.94162	0.0001	0.606028	1.899

Source: Authors calculation

Table 7 shows the estimated coefficient (C1) with a significantly negative value. The figure implies that increased GDP will reduce the open unemployment rate. Thus, the results suggest that Okun's coefficient applies to the Indonesian economy from 1985 to 2018.

5. DISCUSSION

The results of the Vector Error Correction Model test show the significant negative relationship between real GDP and the open unemployment rate. Currently, many labor forces work less than their optimal working hours, as indicated by the fact that the average working hour increases. In a similar vein, increased real GDP is not caused by increased labor forces, but by increased working hours (Central Bureau of Statistics, 2019a). Our findings are supported by Abdul-khaliq *et al*. (2014); Al-hosban and Edienat (2017); Alamro and Al-dala'ien (2016); Arewa and Nwakanma (2012); Bande *et al*. (2017); Blazquenz-Fernandez *et al*. (2018); Darman (2013); Dritsaki and Dritsakis (2009); Kargi (2016); Kori Yahia (2018); Mielcova (2011); Noor *et al*. (2008); Phiri (2014); Pierdzioch *et al*. (2011); Ruxandra (2016); Soylu *et al*. (2018); Zanin and Marra (2011); Lee and Huruta (2019). The results also explain that changes in the unemployment rate are affected by output changes. In other words, increased output growth leads to a decreased unemployment rate and vice versa (Alamro & Al-dala'ien, 2016).

The changes in economic growth are followed by labor needs that will affect unemployment (Darma, 2020). The number of workers' needs can be met by the addition of the average working hours or an addition to the number of workers. If the need for work is met by the addition of working hours, then no additional employment opportunities occur. Thus, increasing economic growth will not affect unemployment. This is consistent with the findings of Alamro and Al-dala'ien (2016); Apergis and Rezitis (2015); Arewa (2012) which indicates when real GDP increases are not followed by full labor demand. Based on the data obtained shows that the increase in economic growth is followed by a decrease in average working hours (Central Bureau of Statistics, 2019a). The argument on the effect of GDP on the open unemployment rate is related to the average working hours, as indicated by Figure 4 below.

Figure 4 demonstrates the relationship between real GDP and average weekly working hours. Real GDP exhibits an increasing trend each year except in 1998, which shows a modest decline. Meanwhile, the average working hours exhibit a declining trend. The figures suggest that increased real GDP is not necessarily followed by increased working hours. When real GDP increases, demand on labor forces should follow. However, increased average working hours suggest that the demand for increased labor capacity is not fulfilled by increased labor forces but by increased working hours (Alamro & Al-dala'ien, 2016; Apergis & Rezitis, 2015; Arewa & Nwakanma, 2012). Further, additional capital and technology development causes the inverse relationship between real GDP and the average working hours (Rahman & Mustafa, 2015). Thus, capital investments and technology development reduce labor absorption and working hours.

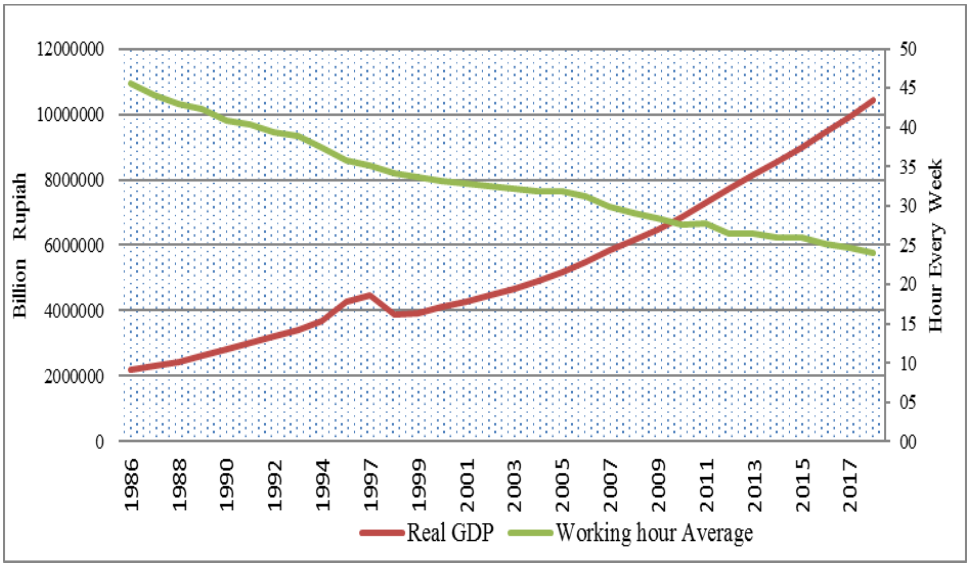

Figure 4. Real GDP and Working Hour Average
Source: Central Bureau of Statistics (2016a, 2018d, 2019a)

A high unemployment rate is also affected by the gap between education groups that fail to meet the demands of the labor market (Alamro & Al-dala'ien, 2016). However, different from Alamro and Al-dala'ien (2016), our linear regression finds that GDP has significantly positive effects on labor forces with various educational backgrounds, from elementary school to university levels (Dimian *et al.*, 2018; Zanin, 2016). Labors with senior high school (general) degrees exhibit the greatest coefficient, followed by those with junior high school and university degrees. The figures suggest that employment opportunities are open for general jobs, especially for junior and senior high school degree holders. Meanwhile, highly skilled job opportunities need labor forces with a university background because they need special competencies. However, job opportunities for diploma (vocational tertiary education) are relatively limited. Further, the link-and-match program through vocational senior high school exhibits a high coefficient, just below of the university (Alamro & Al-dala'ien, 2016; Dimian *et al.*, 2018). This figure indicates that the needs for specific jobs (specific competencies) increase. Table 8 below displays the results:

Table 8. The Impact of Real GDP on Labor Forces by Education Level

Education Levels	Constant	Coefficient	Prob.
No schooling	12521531	-0.981057	0.0000
Incomplete elementary school	18325783	-0.390236	0.0296
Elementary School	27097744	0.745478	0.0095
Junior Secondary School	3199604.	2.168449	0.0000
Senior Secondary School (general)	-1968381.	2.465840	0.0000
Senior Secondary School (vocational)	-17816.31	1.239081	0.0000
Diploma	-13063.25	0.376587	0.0000
University	-3949196.	1.437467	0.0000

Source: Authors calculation

Different from those with degrees from elementary school to universities, the linear regression shows that Real GDP exhibits a significantly negative impact on labor forces for

those who did not go to school at all or who did not complete their elementary school. Thus, higher Real GDP implies that labor forces from these groups decrease. We explain our findings by noting that the government has launched several programs such as *Kelompok Belajar* (Study Group) Package A, Package B, and Package C that are organized outside working hours to enable these labor forces to have exams outside their working hours. Further, these laborers are facilitated to participate in Package A Study Group, thus reducing the number of labor forces with no elementary school degree. It is worth noting that the Package A Study Group degree is equivalent to elementary school degree, the Package B Study Group degree is equivalent to junior high school degree, and the Package C Study Group degree is equivalent to junior high school (general) degree.

Besides, Real GDP also affects labor forces based on age groups. The effect of real GDP on the open unemployment rate can be explained by the number of population ages 15 years or above who work according to age group and education level group (Zanin, 2014, 2016; Zanin & Marra, 2011). The number of labor forces is divided into ten age groups. Table 9 below displays the results of the regression analysis.

Table 9. The Impact of Real GDP on Labor Forces based on Age Groups

Age Groups	Constant	Coefficient	Prob.
15-19	7751784.	-0.322823	0.0000
20-24	7384431.	0.467674	0.0000
25-29	8766558.	0.608854	0.0000
30-34	7604517.	0.903891	0.0000
35-39	7324762	0.902876	0.0000
40-44	4716637.	1.141688	0.0000
45-49	3998095.	0.986835	0.0000
50-54	2861494.	0.876895	0.0000
55-59	1643874.	0.670239	0.0000
60+	3144053.	0.825481	0.0000

Source: Authors calculation

Table 9 shows Real GDP has a significantly negative impact on labor forces with ages between 15-19 years. When Real GDP increases, the number of labor forces in this age group decreases. Increased Real GDP indicates the economy is in good condition and labor forces in the 15-19 years age group tend to choose to continue their study to universities instead of entering the labor market. These labor forces opt for continuing their education to tertiary levels because they consider this option will increase their future productivity and outputs (human investment) (Rahman & Mustafa, 2015). Further, labor forces in the age range of 40-44 years exhibit the largest coefficient, followed by those with the age range of 45-49 years. Thus, increased Real GDP absorbs most labor forces with the age range of 40-44 years, followed by labor forces with the age range of 45-49 years old. In this respect, productive-age labor forces have the high physical ability, and they are more mature and experienced that firms need these labor forces for their activities (Rahman & Mustafa, 2015). With sufficient working experience, these labor forces will increase their skills and eventually their productivity (Moroke, 2014; Noor *et al.*, 2008). In other words, skills are the function of experience (learning curve).

6. CONCLUSIONS

Unemployment is a serious problem for developing countries such as Indonesia. Unemployment itself can be controlled to some extent, depending on the types and causes of unemployment. Indonesia has launched numerous economic reforms, such as open trade,

privatization, and facilitating foreign investments. However, regional and global economic crises have affected and suppressed the Indonesian economy. Slower GDP growth and a two-digits unemployment rate require the Indonesian government to find applicable solutions such as creating many employment opportunities for the young population. Besides, increased prices of goods and services such as oil, gas, raw materials, electricity, and are also affected by the global economic crisis, regional instability, and corruption.

The absorption of labor based on a certain level of education is indicated to reduce employment opportunities for those without education. Similar to those who have an education but are not following the available jobs. The increase in GDP was followed by increased employment opportunities in education groups such as elementary, junior high, high school (general), high school (vocational), Diploma, and University. This explains that Okun's law applies only to certain education groups.

Furthermore, the absorption of the workforce in terms of the age group shows that only a certain age has the greatest coefficient value as in the age group 40-44 years (1.14 percent). Followed by the age group 45-49 years with a coefficient of 0.98 percent. Thus in this age group the labor force increases. It can indirectly explain that Okun's law does not apply to all age groups.

The empirical results indicate that Okun’s coefficient also applies to an emerging country like Indonesia. So far, the government has relied on fiscal and monetary policies to control and to stabilize the unemployment rate to some extent. Productivity will increase if the labor market absorbs more labor forces. The increase in productivity implies increased economic growth. The findings are in line with macroeconomic policies to determine optimal growth. Therefore, the Indonesian government can consider the investment to increase GDP. When investment increases, GDP will increase and at the same time reduce unemployment. The Indonesian government needs to increase direct investment (government investment) and ensure the management of private investment through the Ease of Doing Business (EoDB).

As an archipelago country, Indonesia’s implementation of policies to take a longer time. Consequently, the next study can consider the dynamic panel data and bootstrapping model to indicate the dynamics between gross domestic product and unemployment in each time series and for each province in Indonesia. Also, investigating the time-varying sensitivity of macroeconomic factors that influence the relationship between GDP and unemployment over time.

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